

TAXONOMIC REVIEW OF THE MEXICAN SKINKS OF THE *EUMECES BREVIROSTRIS* GROUP

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ABSTRACT: The nominal species *Eumeces dicei* and *E. indubitus* are shown to be subspecies of *E. brevirostris*. *Eumeces copei* is removed from the *E. anthracinus* group and placed in the *E. brevirostris* group. A critical analysis of squamation and color pattern is presented for the group. Keys, photographs, and distribution maps are given for each form. A possible explanation for the present distributional patterns of the populations of *E. brevirostris* is presented.

INTRODUCTION

While conducting an ecological survey of the herpetofauna of the Navado de Colima in southwestern Jalisco, Mexico, I collected a series of skinks belonging to the *Eumeces brevirostris* group but could not allocate them to species. An examination of specimens comprising the group indicated that discrepancies existed in certain characters used to define the species. Such characters as the length of the dorsolateral light line, interparietal enclosed or not, seventh supralabial in contact with the upper secondary temporal scale or not, number of supraoculars, supraoculars in contact with the frontal, transverse dorsal and longitudinal dorsal scale rows, and the presence or absence of a lateral light line, proved to be more variable than reported by other workers (Taylor, 1935; Smith and Taylor, 1950; Tanner, 1958). A systematic analysis seemed necessary for a redefinition of the species of the *E. brevirostris* group.

CHARACTERISTICS OF THE *EUMECES BREVIROSTRIS* GROUP

Scales: The group is characterized by having the scale following the postgenial wider than long; one postmental scale, and postnasal scales absent; seventh supralabial scale usually in contact with upper secondary temporal scale, occasional contact on one side only or absent in a few individuals of *Eumeces brevirostris*, *E. dugesi*, *E. colimensis*, and in most specimens of *E. copei*; three anterior supraocular scales in contact with frontal on each side, except in *E. dugesi*, with two; four supraocular scales on each side, except in *E. dugesi* with three; interparietal scale either enclosed by the parietal scales or abutting with nuchal scales; frontonasal scale either in contact with frontal or separated from it by prefrontals or an asygous scale; primary temporal scale, if present, in contact with lower secondary temporal scale; primary temporal

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scale frequently fused to upper secondary temporal or absent in some species; two tertiary temporal scales, lower scale often hidden by auricular scales; transverse dorsal scale rows 49 to 68; longitudinal dorsal scale rows 20 to 28; lamellae beneath the fourth row 10 to 17.

Color patterns: Color pattern of the various species of the *Eumeces brevirostris* group is relatively stable but shows some loss of the boldness of pattern with age. Older individuals tend to lose the black or brown pigment, with a darkening of the white to cream yellow light lines on the head and dorsum. The color pattern is usually consistent for any given population but, in some cases, a cline may be found in the width, length, and distinctiveness of some of the lines in adjoining populations. No light median lines or bifurcating light lines occur on the head or body.

The color pattern of the various populations of the *E. brevirostris* group consists of six major longitudinal lines as follows: (1) dorsolateral light line—varying length, usually beginning on the rostral, passing posteriorly along the outer edge of the supraoculars, nuchals, and on longitudinal scale rows two, three, and sometimes four; (2) lateral light line—varying length, beginning on the supralabials, passing posteriorly to the ear, arm, hind limb, or tail, usually on longitudinal scale rows four, five, six, and seven, or a combination of any of these in sequence; (3) primary lateral dark line—beginning near the nostril, passing posteriorly along side of head, neck, body, and sometimes onto tail, usually covering longitudinal scale rows three, four, five, and six, or a combination of any of these in sequence; (4) upper secondary dark line (not always present)—varying length along the inner border of the dorsolateral light line, usually beginning on the frontonasal, passing posteriorly along the middle of the supraoculars and along longitudinal scale rows one, two, or three; (5) lower secondary dark line (not always present)—beginning on the neck on longitudinal scale rows five, six, or seven, sometimes present over the arm and along the side of the body to the hind limb and sometimes onto the tail, usually present on longitudinal scale rows five, six, seven, and eight, or any combination of these in sequence at midbody; (6) dorsal dark lines (interrupted occasionally, often absent)—various lengths, usually extending from the nuchals to above the hind limbs, usually located between two longitudinal scale rows, such as a median line between the paravertebral rows and between longitudinal scale rows two and three (*E. copei*) or passing down the center of each paravertebral row (as in some *E. brevirostris pineus*).

The presence, absence, length and position of each line on a particular longitudinal scale row is important in diagnosing species of the group. For this reason the method of counting is given below.

Longitudinal scale rows are counted from the paravertebral (first) row, laterally. Transverse scale rows are counted from the first nuchal to above the anus. Frequently, lines shift position from one row to another, usually between the neck and midbody; for example, a dorsolateral light line on the lower half of the second longitudinal scale row for four transverse scales may shift to the

middle one-third of the third longitudinal scale row for 54 transverse scale rows. If a line is wider than one scale row, e.g., the lateral dark line, it may be found on the lower half of the third longitudinal scale row through the upper half of the fifth on the neck, shifting to the lower half of the fourth longitudinal scale row through the upper half of the sixth at midbody.

TAXONOMIC ARRANGEMENT OF THE SKINK

GROUP *EUMECES BREVIROSTRIS*

I propose the following changes in the most recently published taxonomic arrangements of the species of the *Eumeces brevirostris* group (Smith and Taylor, 1950; Tanner, 1958).

Previous status	Current allocation
<i>E. brevirostris brevirostris</i> (Günther)	= <i>E. brevirostris brevirostris</i>
<i>E. brevirostris bilineatus</i> Tanner	= <i>E. brevirostris bilineatus</i>
<i>E. dicei dicei</i> Ruthven and Gage	= <i>E. brevirostris dicei</i> New Combination
<i>E. dicei pineus</i> Axtell	= <i>E. brevirostris pineus</i> New Combination
<i>E. indubitus</i> Taylor	= <i>E. brevirostris indubitus</i> New Combination
<i>E. colimensis</i> Taylor	= <i>E. colimensis</i>
<i>E. copei</i> Taylor	= <i>E. copei</i>
<i>E. dugesii</i> Thominot	= <i>E. dugesii</i>
<i>E. ochoterena</i> Taylor	= <i>E. ochoterena</i>

Taylor (1936) indicated that *E. copei* belonged with the five-lined forms of the *anthracinus* group, but was the least typical of the group. A primary character of the *brevirostris* series group is the presence of a scale that is wider than long following the postgenial scale. *Eumeces copei* has this condition, while members of the *anthracinus* group have the scale following the postgenial longer than wide. The dorsolateral light lines arise on the rostral in the *brevirostris* group and in *E. copei*, but on the last supraocular in the *anthracinus* group. A median dorsal light line is absent in the *brevirostris* group and *E. copei*, but is present in the *anthracinus* group. As the principal characters of *E. copei* ally the species to the *brevirostris* group, it is removed from the *anthracinus* group.

The characters used to define the species and subspecies of *E. dicei* overlap to a considerable extent with features of populations of *E. brevirostris* from the Sierra Madre Occidental (*bilineatus*), Oaxacan Highlands and Sierra Madre del Sur (*brevirostris*). The two subspecies of *E. dicei* are similar to *E. brevirostris bilineatus* in most characters of squamation but differ in the absence of an enclosed interparietal scale and in minor features of color pat-

tern. The interparietal scale is enclosed in all specimens of *bilineatus* examined, 12 per cent of *brevirostris*, not in *dicei*, and in two per cent of *pineus*. In this character *dicei* shows a closer relationship to the nominate form of *brevirostris* found to the south of *dicei* than to *bilineatus* to the west.

The primary temporal scale is absent in all *dicei*, in 93 per cent of *pineus*, in 60 per cent of *bilineatus* and in three per cent of *brevirostris*, indicating a close relationship in eastern populations of *brevirostris* in this character.

The number of dorsal, longitudinal, and transverse scale rows, fourth toe lamellae, superciliary scales, and postsubocular scales in *dicei* all overlap among individuals of populations of *brevirostris* from western and southern Mexico (Tables 1 & 2).

The dorsolateral light line is about one scale wide in *brevirostris dicei* and is somewhat obscure at the shoulder. The line is about two scales wide and usually distinct to the hind limb in *pineus* and *bilineatus* and about two scales wide but variable in length in populations of *brevirostris* from central and southern Mexico. The lateral light line is present in southern populations of *brevirostris* but usually obscure in *dicei*, *pineus*, and some individuals of *bilineatus*. The lateral dark field is about three scales wide in *dicei*, *pineus*, *bilineatus*, and one and a half to two and a half scale rows wide in southern and central populations of *brevirostris*. *Eumeces b. dicei* and *E. b. pineus* are somewhat lighter in color than western and southern populations of *brevirostris*.

The presence of four dark, dorsal longitudinal lines on the middle one-third of the first and second scale row on each side serves to distinguish *dicei* and *pineus* from all populations of *brevirostris*. The samples of *brevirostris* have four to seven dark, dorsal longitudinal lines, but the lines are found between the first, second, third, and infrequently the fourth scale rows. The lines are occasionally absent or obscure in *dicei* and *brevirostris*.

The above data indicate that *dicei* and *pineus* share a combination of a number of characters found in western, southern, and central populations of *brevirostris* and are considered as members of *E. brevirostris* Rassenkreis.

Eumeces indubitus is essentially similar to *E. brevirostris* in all characters of squamation. The only useful character for separating populations of *E. brevirostris* and *E. indubitus* is the absence of a lateral light line from the ear to the hind limb. The lateral light line is replaced on the side of the neck in *E. indubitus* by a series of scales that have white anterior edges and centers with black posterior borders, on longitudinal scale rows five, six, seven, eight, and nine, or any combination of these rows in sequence. In addition, all samples of *E. indubitus* with the above character have the interparietal enclosed posteriorly by the parietals in 92 per cent or more of the specimens. However, a population of *E. brevirostris* from the vicinity of Rio Frio, Mexico (state), has the interparietal enclosed in 38 per cent of the sample, but has a lateral light line on the neck on longitudinal scale rows six and seven. Where the ranges of *E. indubitus* and *E. brevirostris* approach one another (between

Cuernavaca and Tepoztlán, Morelos; a distance of 11 miles), some individuals have enclosed interparietals and a faint lateral light line on the neck or a non-enclosed interparietal without a lateral light line on the neck. The shifting of characters between the two populations along a narrow zone of contact belies the contention that they represent two distinct species, and I consider *E. indubitus* conspecific with *E. brevirostris*.

KEY TO THE MEMBERS OF THE *EUMECES BREVIROSTRIS* GROUP

The key to the species and subspecies of the *E. brevirostris* group must be used with care. Skinks are notorious for being conservative, so conservative that most scale characters utilized in the key overlap to some degree with these features in every other species of the group. If doubt remains as to the identity of the specimen at hand, the color pattern description, photographs, and maps will supplement the key.

KEY TO THE *EUMECES BREVIROSTRIS* GROUP

- 1a. Three supraoculars *dugesii*
- 1b. Four supraoculars (occasionally three) 2
- 2a. Dorsolateral light line restricted to third scale row from middle of neck to hind limb *copei*
- 2b. Dorsolateral light line on second and third or second, third and fourth scale rows from middle of neck to midbody or hind limb..... 3
- 3a. Longitudinal scale rows 26 to 28; fourth toe lamellae 15 to 17; toes overlap when limbs adpressed along side of body..... *colimensis*
- 3b. Longitudinal scale rows 20 to 26; fourth toe lamellae 10 to 15; toes separated by five or more body scale when adpressed along side of body..... 4
- 4a. Transverse dorsal scale rows 49 to 57 ($x = 53.7$), maximum snout-vent length 52 mm ♂♂, 55 mm ♀♀; primary temporal contacting lower secondary temporal in 45 per cent of population; dorsolateral light lines separated from one another by two or two and two half-scale rows at midbody *ochoterenae*
- 4b. Transverse dorsal scale rows 50 to 68 ($x = 59.0$), maximum snout-vent length 70 mm ♂♂, 73 mm ♀♀; primary temporal contacting lower secondary temporal in less than one per cent of population; dorsolateral light lines separated by three and two half-scale rows or four scale rows at midbody *brevirostris*

KEY TO THE SUBSPECIES OF *EUMECES BREVIROSTRIS*

- 1a. Interparietal usually enclosed by parietals..... 6
- 1b. Interparietal usually not enclosed by parietals..... 2
- 2a. Primary temporal usually present..... 4
- 2b. Primary temporal usually absent..... 3
- 3a. Broad lateral dark stripe on fourth scale row of body (Nuevo Leon, Tamaulipas *b. dicei*

- 3b. Broad lateral dark stripe on third scale row of body (Nuevo Leon, Coahuila, Tamaulipas) *b. pineus*
- 4a. Lateral light line present from ear to hind limb (Guerrero, Oaxaca) *b. brevirostris*
- 4b. Lateral light line obscure or absent 5
- 5a. Lateral light line from ear to arm on scale rows six and seven, bordered below by thin black line (Mexico, Morelos, Puebla, Veracruz) *b. brevirostris*
- 5b. No definite light line from ear to arm bordered below by thin black line (longitudinal scale rows six, seven, eight, and nine may have light centered, dark scales) 6
- 6a. Primary temporal absent in 60 per cent of sample; no lateral light line on neck; neck scales whitish from scale row five or six, grading into light belly color; dorsolateral light line may extend to tail or beyond (Chihuahua, Durango) *b. bilineatus*
- 6b. Primary temporal present in 96 per cent or more of sample; lateral light line of neck consists of a series of light centered, dark scales on scale rows five, six, seven, eight, and nine, or any combination of these in sequence; dorsolateral light line usually faint at shoulder and beyond (Morelos, Mexico, Jalisco) *b. indubitus*

DESCRIPTION OF SPECIES AND SUBSPECIES

***Eumeces brevirostris brevirostris* (Gunther, 1860)**

Maximum snout-vent length 70 mm for ♂♂, 73 mm ♀♀; color pattern consists of a dorsolateral light line usually beginning on rostral, passing posteriorly along the outer one-third of supraoculars, nuchals, lower one-third of the first and upper one-third of the second longitudinal scale row, shifting to the lower one-third of the second and most of the third longitudinal scale row at middle of neck and/or anterior one-third of body, fading posteriorly or distinct to the hind limb; dorsal dark lines may be distinct and continuous, dashed, spotted, obscure, or absent, but if the former, usually present between the paravertebral rows and between longitudinal scale rows one and two, two and three, and sometimes three and four posteriorly; upper secondary dark line begins on the prefrontals, passing posteriorly along middle one-third of nuchal, lower edge of longitudinal scale row one and upper one-third of two to the level of the arm or fading between arm and midbody; dorsal area between dark lines light bronze to dark brown; primary lateral dark line (stripe) usually begins on upper edge of nostril, passing through side of head to level of upper edge of supralabials, posteriorly along the upper edge of post suboculars and above ear, on lower edge of longitudinal scale row two through upper edge of six on neck, on lower one-third of third through upper half of fifth row at midbody; lateral light line may be long (Oaxaca, Guerrero, Figs. 1a and b) or short (Mexico, Morelos, Puebla, Veracruz, Distrito Federal, Figs. 1c and d), but

always present from the supralabials to arm on fifth and sixth or sixth and seventh longitudinal scale rows of neck and in southern populations from the arm to hind limb on fifth, fifth and sixth, or sixth longitudinal scale rows at midbody; lateral light line bordered below by lower secondary dark line from the lower edge of the supralabials through the neck and to the hind limb in southern populations.

Miss Alice G. C. Grandison (*pers. comm.*) kindly supplied me with information on the holotype of *E. brevirostris* (Fig. 2) in the British Museum (Natural History): "There is a dorsolateral light line on the lateral half of scale row two and median half of scale row three, and lateral to this line there is a broad dark band which in width extends from the lateral half of the third scale row to the median half of the sixth row. The light line referred to extends from the tip of the snout along the lateral edge of the supraoculars, the lateral half of the parietal and the nuchal to become a dorsal lateral stripe. The line is dark edged medially, the edge occupying a small blob in approximately the central area of the second scale row. I confirm that there is evidence of a lateral light line from the upper lip, over the shoulder, to the hind limb." This color pattern is typical for individuals of *brevirostris* from Oaxaca (Fig. 2).

Squamation: The number of supraoculars contacting the frontal is usually three on each side but occasionally may be two on each side or two on one side and three on the other; number of supraoculars usually four on each side but occasionally may have three on each side (one specimen of 102) or three on one side and four on the other (two specimens). This condition appears to be a fusion of one supraocular with another rather than the loss of one. One specimen from Oaxaca has the fourth supraocular of one side transversely divided, producing five supraoculars on that side.

The amount of contact of the seventh supralabial with the upper secondary temporal is relatively constant but the number of scales in the superciliary series and the enclosure of the interparietal are variable (Table 1). The presence of a primary temporal is relatively constant, but one specimen has the primary temporal fused to the upper secondary temporal on both sides and another individual has the upper secondary temporal vertically divided on one side.

The mean number of dorsal transverse scale rows is nearly constant for samples for Veracruz, Puebla, and Mexico-Morelos, while those from Oaxaca and Guerrero are lower, but a statistical analysis of the five samples reveals a considerable overlap of variation between samples. The mean number of longitudinal scale rows around the body is lower in the Oaxaca sample, while the remaining four samples are relatively uniform. The mean number of lamellae beneath the fourth toe are identical in the Oaxaca and Guerrero samples and increases slightly to the north and west in the remaining samples (Table 2).

A statistical analysis of the squamation characteristics in populations of *b. brevirostris* and *b. indubitatus* indicates no differences (Table 2). The color

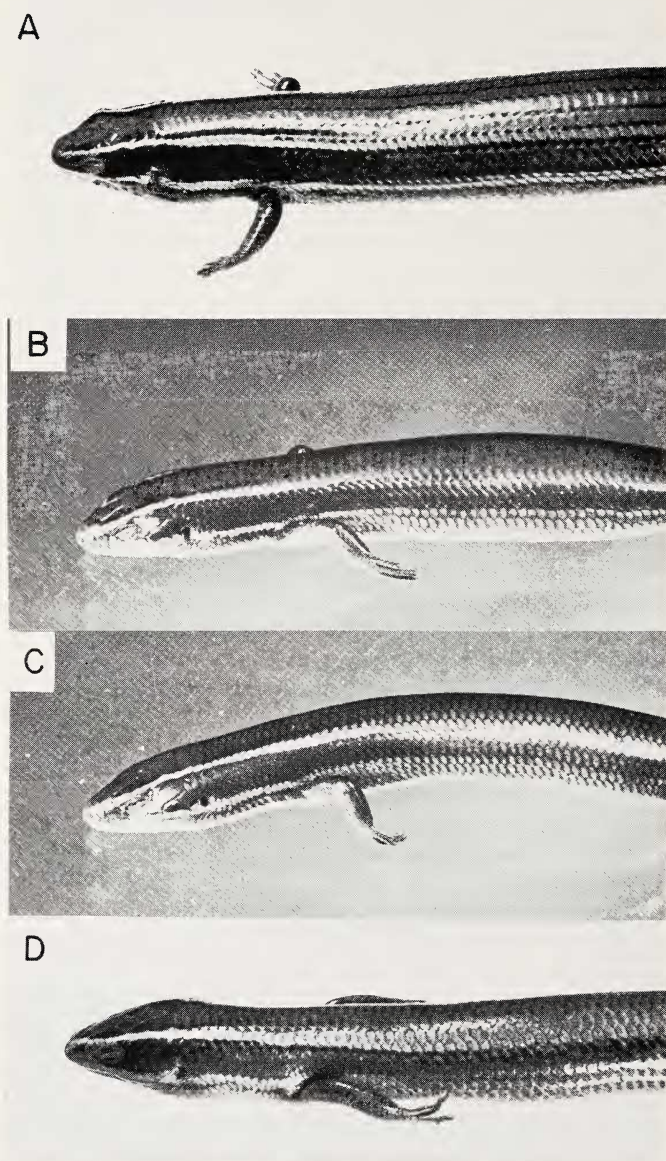


Figure 1. A dorsolateral view of the color pattern of *Eumeces breviostris brevirostris*. A. Tejocotes, 7800 ft, Oaxaca; B. 2 mi SW Omilteme, 7900 ft, Guerrero; C. near E. Seco, 7100 ft, Puebla; D. 23.9 mi NW Toluca, 7600 ft, Mexico. Note the shortening of the lateral light line in C and D.

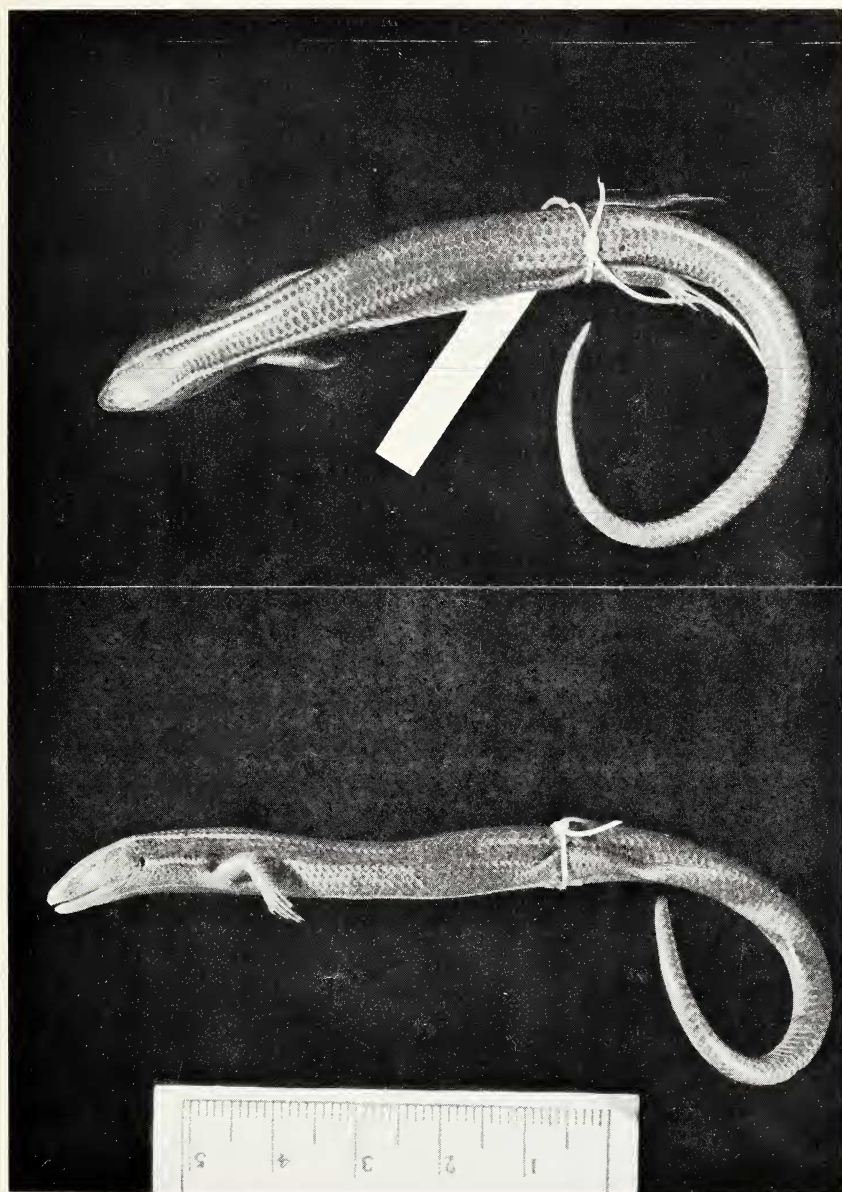


Figure 2. Holotype of *Eumeces brevirostris* Gunther, from Oaxaca, Mexico. By permission of the Trustees of the British Museum (Natural History).

pattern of individuals intermediate between the two populations is discussed in the preceding section.

Localities, museum depository, number of specimens examined, and pertinent literature records: *GUERRERO*; Omilteme, FMNH, 11, UIMNH, 5; 2 mi SW Omilteme, TCWC, 23; 5 mi W Mazatlan, TCWC, 2; 4 mi W Mazatlan, TCWC, 3; 3 mi W Omilteme, MVZ, 1. *MEXICO*; Rio Frio, KU, 12, UMMZ, 7; Rio Frio and road from Puebla to Mexico, UMMZ, 4; 23.9 mi NW Toluca, MVZ, 1; Ajusco Mountains, between Mexico City and Cuernavaca, FMNH, 1. *MORELOS*; Laguna de Zempoala, UMMZ, 2; near Huajintlan, km 133, FMNH, 1; Tepozatlan, FMNH, 1. *OAXACA*; Rancho Mira Cumbre, UMMZ, 1; 32.5 mi W Oaxaca, UMMZ, 1; 24 km NNE Oaxaca, UMMZ, 2; 27 km NNE Oaxaca, UMMZ, 2; Oaxaca, UIMNH, 2, FMNH, 1; La Parada, USNM, 1; 3 km W San Vicente Lochixio, KU, 1; 18 km N, 33 km W Oaxaca, TCWC, 1; between Pluma Hidalgo and Copalitos, AMNH, 2; Pluma Hidalgo, AMNH, 1; near continental divide, 3 mi N Tierra Colorada, AMNH, 4; 5 mi S Llano de las Flores, Sierra Juarez, AMNH, 3; 2 mi E Ixtlan de Juarez, AMNH, 2; El Punto, AMNH, 11; 1 mi S El Punto, near Cerro San Felipe, AMNH, 1; Cerro San Felipe, UIMNH, 13; north slope of ridge E Cerro San Felipe, AMNH, 8; Tejocotes, AMNH, 2; 6 mi N Cumbre del Estudiante, AMNH, 2; 3.5 mi N Cumbre del Estudiante, AMNH, 5; southwest ridge of Zempoaltepetl, AMNH, 1; 11 mi S Sola de Vegas, AMNH, 1; northeast of San Andres Chicahuaxtla, AMNH, 14, UIMNH, 2; 9.8 mi NE San Juan del Estado, AMNH, 1; Lachixorax, above Aseradero, UIMNH, 1; 8 mi SE Nochixtlan, UIMNH, 5; 9 mi SE Nochixtlan, AMNH, 1; 13 mi NE Nochixtlan, UIMNH, 1; San Jose Lachiguiri (Taylor, 1943); Tehuantepec (Smith and Taylor, 1950). *PUEBLA*; Pajaro Verde, UIMNH, 1; 24 km W Texmelucan, USNM, 3; Laguna San Bernardino, FMNH, 4, UIMNH, 1; near El Seco, km 205, UIMNH, 4, FMNH, 4; near Acultzingo, FMNH, 1; 4 mi NE Esperanza, Sierra Negra, UMMZ, 1; near Rio Frio, UIMNH, 11; east of Rio Frio, FMNH, 4, UIMNH, 1; 5 mi E Rio Frio, MVZ, 1; 6 mi E Rio Frio, MVZ, 1. *VERACRUZ*; 3 km W El Limon, KU, 1; San Antonio Limon, Totalco, UIMNH, 3, FMNH, 2; Totalco, FMNH, 3; near Totalco, UIMNH, 8; FMNH, 12; Perote, USNM, 1; Orizaba, USNM, 2; Laguna (Smith and Taylor, 1950).

Eumeces brevirostris brevirostris X *brevirostris indubitus*: *MORELOS*; km 58, road to Cuernavaca, FMNH, 1; 5 km N Tres Marias, UIMNH, 1; 5 mi E Cuernavaca, MVZ, 1.

***Eumeces brevirostris indubitus* Taylor, 1933**

The maximum snout-vent length for this subspecies is 69 mm ♂ ♂, 71 mm ♀ ♀; color pattern consists of a dorsolateral light line beginning on rostral, passing posteriorly along the outer half of supraoculars, median one-third of nuchal, outer two-thirds of second longitudinal scale row, descending to outer one-third of second and upper two-thirds of third row at shoulder, fading

posteriorly and obscure at midbody; dorsal dark lines usually obscure but, if distinct, similar to the pattern found in the nominate subspecies; upper secondary dark line begins on prefrontals and terminates between head and shoulder, usually found on upper one-third of second longitudinal scale row but sometimes including the outer edge of the first row; primary lateral dark line (stripe) is brownish black and begins on or near nostril, covering side of head from level of supralabials and sometimes including most of latter, passing posteriorly through ear, on lower one-third through upper half of sixth row on neck (upper edge of seventh, eighth, and ninth rows often black), on lower three-fourths of fourth through sixth scale row at midbody; lateral light line represented by narrow white line on supralabials, by a series of light centered, dark edged scales on sixth and seventh, sometimes eighth and ninth rows on neck, and usually absent on the side of the body; lower secondary dark line usually united with primary lateral dark line, *i.e.*, absent (Fig. 4a).

Ten individuals of 41 from Morelos and Mexico have a faint indication of a lateral light line, represented by a series of light centered, dark scales on the fifth and sometimes the sixth longitudinal scale row at midbody, lending further support to the conspecific status of *indubitus* and *brevirostris*.

The color pattern of the sample from Jalisco is similar to the Morelos and Mexico sample, but usually lacks the lateral light line on the supralabials (Fig. 4b). The upper secondary dark line is longer, extending posteriorly to midbody in most specimens. The lateral light line is represented by light centered, dark scales on the seventh and eighth scale rows on the neck rather than the fifth, sixth, seventh, eighth, or ninth, or any combination in sequence. Juveniles and sub-adults have similar color patterns but usually more distinct lines and contrasting colors.

Squamation: Variation in squamation among three samples of *b. indubitus* (Mexico, Morelos, and Jalisco) is presented in Tables 1 and 2. Minor differences occur in the number of longitudinal scale rows and lamellae beneath the fourth toe between the Jalisco samples and those farther east. The ratio of juveniles and adults of the Jalisco sample having 26 longitudinal scale rows are 39 and 47 per cent, respectively, out of a sample of 51 individuals. The mean number of transverse dorsal scale rows varies less than one scale between all three samples. The number of supraoculars are four on each side in all three samples; number of supraoculars contacting the frontal are usually three on each side, but occasionally two contact the frontal on each side (7 per cent) or two on one side and three on the other (5 per cent).

The head scales of one individual from Talpa, Jalisco, are aberrant, having the upper secondary temporal vertically divided on both sides, forming what appears to be two primary temporals in tandem. This, in effect, allows a contact between the anterior half of the split upper secondary temporal and the lower secondary temporal. Fusion of the primary temporal with the upper secondary temporal occurs on one side in two specimens and on both sides in a third.

A single specimen from Puerto Hondo, near Zitacuaro, Michoacan, is listed by Taylor (1936) and Duellman (1961) as *E. indubitus*. This individual, FMNH 106577, is a specimen of *E. dugesi*, apparently mis-identified by Taylor and Duellman because of its small size (juvenile, 36 mm in snout-vent length). The specimen clearly has three supraoculars on each side and the color pattern of *E. dugesii*.

Localities: *JALISCO*; 7 mi W Atenquique, LACM, 30, MSU, 1, KU, 2; 6.4 mi W Atenquique, KU, 3; 8 km SE Jasmin, UMMZ, 3; 0.5 mi SE El Isolte, UMMZ, 1; 0.5 mi N Garcia, UMMZ, 1; 10 mi W Ciudad Guzman, UMMZ, 1; 3 km NE Talpa, KU, 1; Talpa, Mascota, FMNH, 1; La Cumbre de los Arrastrados, BM(NH), 5; Sierra de Jaunocatlan, La Laguna (Tanner, 1958). *MEXICO*; near Asuncion, 40 mi NE Zitaquaro, USNM, 1, UIMNH, 4, FMNH, 9; Tenancingo, FMNH, 1. *MORELOS*; 5 km S Tres Marias (Tres Cumbres), FMNH, 1, UIMNH, 2; km 61, near Cuernavaca, FMNH, 3, UIMNH, 2; km 63, near Cuernavaca, FMNH, 4, UIMNH, 2 (type locality); km 58, near Cuernavaca, FMNH, 3, UIMNH, 2; 7.5 mi N Cuernavaca, MVZ, 1; Cuernavaca, UIMNH, 1, USNM, 1; Zempoala, UIMNH, 1.

***Eumeces brevirostris bilineatus* Tanner, 1958**

The maximum snout-vent length for *b. bilineatus* is 60 mm for ♂♂ and ♀♀; color pattern consists of dorsolateral light line beginning on rostral, passing posteriorly along outer one-third of supraoculars, median one-third of nuchals, most of second longitudinal row on anterior neck, descending to lower half of second and upper half of third row to anterior one-third of body, descending to third row for remainder of body; dorsolateral light line may involve fourth scale row in some specimens either as a series of light centered, dark scales, or upper half of fourth light colored from arm to hind limb; dorsolateral light line variable in length, may be distinct to arm, midbody, or tail, obscure in some old adults; upper secondary dark line begins on rostral or internasal, passing posteriorly along inner one-third of supraoculars, nuchals, and upper half of second scale row for 8 to 15 scales beyond shoulder; dark dorsal lines usually obscure or absent but, if present, found between each scale row of the dorsum between primary lateral dark line; primary lateral dark line begins at nostril, covering side of head from edge of supralabials to superciliary series, passing posteriorly through upper half of ear, on lower half of third through upper half of sixth row of neck, and on all or part of fourth through upper half of sixth row at midbody; upper edge of primary lateral dark line may be partly divided beyond arm (Fig. 4c) on lower edge of third and upper one-third of fourth row, a condition often found in *brevirostris pineus*; lateral light line usually obscure or absent but, if present, found on sixth and seventh rows of neck or lower half of seventh row of neck and lower half of sixth row at midbody (Fig. 4c).

Squamation: Variation in two samples of *b. bilineatus* (Durango and Chihuahua) is given in Tables 1 and 2. The presence or absence of the primary



Figure 3. Map of the distribution of *Eumeces brevirostris brevirostris*, *E. brevirostris indubitus*, *E. copei*, and *E. ochoterenae* in central and southern Mexico.

temporal is variable, occurring on both sides in 33 per cent, one side only in 53 per cent of a sample of 48 specimens. A comparison of characters between the two samples indicates that they are similar, except for the number of scales in the superciliary series. There appears to be a reduction in the number of superciliary scales from south to north in the various populations of *brevirostris*, with the Oaxaca sample having seven scales on each side in 53 per cent, and the Chihuahua sample having none with seven but 63 per cent with six on each side. A similar reduction is found in the number of post suboculars. The enclosed interparietal, number of supraoculars, and seventh supralabial—upper secondary temporal contact is constant for both samples. There are usually three supraoculars contacting the frontal on each side, but occasionally only two on each side (in one) and two on one side, three on the other (in two).

Localities: *CHIHUAHUA*; Mojarachic, UMMZ. 1; 15 mi S, 6 mi E Creel, KU, 2; 2 mi W Samachique, KU, 3; 7 mi SE El Vergel, MVZ, 1; 3 mi NE Rio Verde (town), MVZ, 1; 7 mi SW Lagunita, MVZ, 1. *DURANGO*;

2.5 mi W San Luis, UMMZ, 1; 33 mi W El Salto, 1 mi W Buenas Aires, CSLB, 7; 9 mi SW El Salto, KU, 3; 10 mi SW El Salto, KU, 2; 15 mi SW El Salto, KU, 1; Coyotes, FMNH, 3; near Hacienda Coyotes, UMMZ, 1; 6 mi WSW Los Adjuntas, MVZ, 13; Laguna del Progreso, UMMZ, 4; Ciudad, BM(NH), 2; Ioquiro, Tarahumari, BM(NH), 1; Highway 40, 137 mi E junction of Highways 40 and 15, AMNH, 1; Cueva (Webb and Baker, 1962); 1 mi ESE Cajones (Webb and Baker, 1962).

***Eumeces brevirostris pineus* Axtell, 1960**

The maximum snout-vent length for *b. pineus* is 60 mm ♂♂, 66 mm ♀♀; color pattern consists of a dorsolateral light line beginning on the rostral or internasal, passing posteriorly along outer one-third of supraoculars, nuchals, upper half of second and lower two-thirds of third scale row to hind limb; upper one-third of fourth scale row with series of whitish dots from the neck to hind limb, bordered above by thin black line along outer edge of third scale row; dorsal dark lines usually present on median one-third of first and second scale rows, with dark line of the second row representing the upper secondary dark line; dark dorsal lines may be present as a series of dashes or spots, but usually distinct from rear of head to level of hind limb; primary lateral dark line begins at nostril, covering side of head above supralabials, passing posteriorly over ear, on lower half of third through upper one-third of sixth of neck, lower one-third of third through upper one-third of sixth row at midbody; lateral light line usually absent but, if present (one specimen), represented as a series of light centered, dark scales on sixth and seventh scale rows of neck and seventh row at midbody; lower secondary dark line usually absent; head brownish with dorsal area between dorsolateral light lines light bronze (Fig. 4d).

Squamation: Variation in seven characters of squamation is given in Tables 1 and 2. *Eumeces b. pineus* differs from *b. indubitus* and *b. brevirostris* in the absence of a primary temporal scale in 93 per cent of the sample examined. However, *Eumeces b. bilineatus* exhibits a loss of the primary temporal in 60 per cent and *E. b. dicei* 100 per cent loss in the samples examined.

The number of supraoculars, post suboculars, seventh supralabial—upper secondary temporal contact is almost constant in *b. pineus*. The number of supraoculars contacting the frontal is usually three on each side but occasionally only two contact the frontal on each side (in two specimens), or two on one side and three on the other (in one).

Localities: COAHUILA; 13 mi E San Antonio de las Alazanas, KU, 18, FMNH, 3, AMNH, 1; 7 mi E San Antonio de las Alazanas, AMNH, 2. NUEVO LEON; Ojo de Agua, near Galeana, FMNH, 1; Cerro Potosi, FMNH, 4, AMNH, 2; Pablilla Galeana, FMNH, 4, UIMNH, 5.

Localities for intergrades between b. pineus x b. dicei: TAMAULIPAS; Rancho Ceilo, LACM, 1; El Chique, UMMZ, 1; La Joya de Salas, UMMZ, 8;

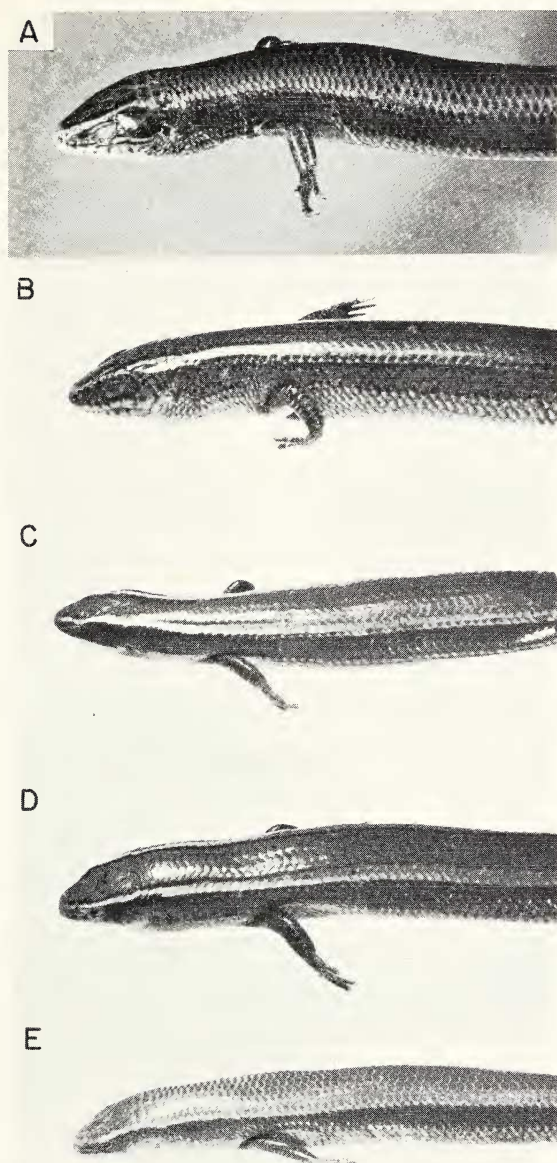


Figure 4. A dorsolateral view of the color patterns of some subspecies of *Eumeces brevirostris*. A. *indubitus*, 61 km, near Cuernavaca, Morelos; B. *indubitus*, 9 mi W Atenquique, Jalisco; C. *bilineatus*, Chihuahua; D. *pineus*, Ojo de Agua, Nuevo León; E. *dicei*, Santiago, Nuevo León.

5 mi NW Gomez Farias; 7 mi WNW Gomez Farias (Martin, 1958; Axtell, 1960).

***Eumeces brevirostris dicei* Ruthven and Gaige, 1933**

The maximum snout-vent length for *Eumeces b. dicei* is 60 mm ♂♂, 61 mm ♀♀; color pattern (Fig. 4e) similar to *E. b. pineus*, with following exceptions: dorsolateral light line thin, usually confined to lower edge of second and upper two-thirds of third scale row from neck to arm, fading posteriorly into light bronze color of dorsum; primary lateral dark line begins at nostril, usually covering side of head but brownish in color, passing over ear, on lower edge of third through upper half of sixth scale row of neck, lower half of fourth through upper three-fourths of sixth scale row at midbody, but may vary half a scale row in either direction in some specimens.

Axtell (1960) examined five specimens of *E. b. dicei* from Tamaulipas and indicated that the dark dorsal lines were usually present between the dorsolateral light lines as a series of linear dark pigment spots. A series of six specimens from Nuevo Leon lack the dark pigment between the dorsolateral light lines except for the upper secondary dark line that occurs from the first supraocular to the parietal in one, to the level of the arm in two and only on the supraoculars in one.

Some of the characters used by Axtell (1960) to separate the two subspecies are variable in the series at hand. The average snout-vent length given by Axtell for *dicei* and *pineus* was 50.7 and 59.3 mm, respectively. The present samples reveal an average snout-vent length for *dicei* and *pineus* as 61.0 and 60.2 mm, respectively. There is considerably more overlap in the variation of position of the primary lateral dark band in each of the two samples than was noted by Axtell. However, the frontonasal-frontal contact and length of limbs serve as distinguishing features for each population.

Based upon intermediate conditions in coloration, the Santiago, Nuevo Leon, sample indicates that this area may be one of secondary intergradation. Unfortunately, most scale characters overlap between the two subspecies and only a statistical trend may indicate which population is at hand. *Eumeces b. pineus* usually has 22 longitudinal scale rows and 24 per cent have contact between the frontonasal and the frontal; *E. b. dicei* usually has 24 longitudinal scale rows and 90 per cent have frontonasal-frontal contact. The Santiago sample is closer to *dicei* than to *pineus* in the latter characters. If this area is a zone of secondary intergradation, then the suppression of *pineus* characters proposed by Axtell (1960) in areas of secondary intergradation also occurs in the Santiago sample.

Squamation: Variation in squamation of 11 specimens is given in Tables 1 and 2 (see Axtell, 1960, for detailed comparison of *dicei* and *pineus*).

Localities: **NUEVO LEON**; Santiago, Hacienda Vista Hermosa, FMNH, 6. **TAMAULIPAS**; 3 mi S Acuna, UMMZ, 2; near Acuna, UMMZ, 1; 12 mi NNW Chamal, UMMZ, 1; Marmolejo (Ruthven and Gaige, 1933).

***Eumeces dugesii* Thominot, 1883**

The maximum snout-vent length for this species is 66 mm ♂♂, 69 mm ♀♀; color pattern consists of dorsolateral light line beginning on rostral, passing posteriorly along outer half of supraoculars, outer one-third of nuchals, outer half of second longitudinal scale row for three to nine scales, descending to outer one-third of second and inner one-third of third for three to six scales, descending to upper half of third row for 9 to 16 scales, fading posteriorly to arm (occasionally descending to fourth row in some specimens and infrequently extending to the hind limb); mid-dorsal area light bronze to copper; upper secondary dark line begins on first supraocular, passing posteriorly through median one-fourth of nuchals, terminating on fourth transverse row of scales, faintly indicated on third longitudinal scale row at midbody (Fig. 8b); primary lateral dark line covers side of head from supraoculars to edge of supralabials, lower half of second through upper half of sixth longitudinal scale rows of neck, lower half of third through upper half of sixth row at midbody; lateral light line from first supralabial through ear to above arm, on lower half of sixth and upper half of seventh longitudinal scale row of neck, becoming a series of light spots on lower half of sixth longitudinal scale row at midbody; lower secondary dark line on lower half of seventh longitudinal scale row of neck, all of seventh at midbody; posterior edges of infra- and supralabials with vertical or slightly oblique black bars; limbs dark brown to black above, belly yellowish below, sometimes bluish gray to light olive.

Squamation: Variation in squamation for 27 specimens of *E. dugesii* is given in Tables 1 and 2. The most unusual character of *E. dugesii* is the presence of three supraoculars. The loss of the first supraocular appears to be due to a fusion of the enlarged first superciliary with the first supraocular. There is wide variation in the number of scales in the superciliary series (Table 1). The primary temporal is absent on both sides in one specimen, absent on one side in two. A small azygous scale is present between the frontonasal and the frontal in two specimens. The number of supraoculars contacting the frontal are two on each side without exception.

Localities: *JALISCO*; 3 mi WSW Mazamitla, KU, 1; Nevado de Colima (Smith and Taylor, 1950). *MICHOACAN*; 2 mi W San Jose, TCWC, 1; Rancho San Jose, USNM, 1; 12 mi S Carapan, KU, 5; Puerto Hondo, FMNH, 1; 9 mi W Zacapu, near Cerro Tecolote, UIMNH, 1; El Soledad, Tancitaro, FMNH, 2; 11 mi S Patzcuaro, AMNH, 4; 1.7 mi W San Jose de la Cumbre, UMMZ, 1; 7.2 mi N Cheran, UMMZ, 1; 4.5 mi WNW Cheran, UMMZ, 4; 2.3 mi N Opopeo, UMMZ, 2; Uruapan, Parque Nacional, UMMZ, 1; near Carapan (Taylor, 1943); Tangancicuaro, Patamban, Apatzingan (Smith and Taylor, 1950).

***Eumeces copei* Taylor, 1933**

The maximum snout-vent length for *E. copei* is 66 mm ♂♂, 73 mm ♀♀; color pattern consists of a dorsolateral light line beginning on rostral,

passing posteriorly along outer third of supraoculars, nuchals, most of second longitudinal scale row for one to three transverse rows, descending to middle third of third longitudinal scale row to tail; upper secondary dark line begins on outer edge of rostral, passing posteriorly along inner half of supraoculars, nuchals, upper edge of second longitudinal scale row for two to ten transverse scales, descending to upper one-third of third longitudinal scale row to the tail; dorsal dark lines present between paravertebral rows and one each between longitudinal scale rows one and two; dorsal coloration between upper secondary dark lines bronze to dark brown; primary lateral dark line covers side of head from supraoculars to supralabials, on lower half of third through upper half of sixth longitudinal scale row of neck, shifting to lower one-third of third through upper half of fifth longitudinal scale row at midbody; lateral light line present from lower edge of first supralabial to tail, on lower two-thirds of sixth through upper half of seventh longitudinal scale row of neck, lower half of fifth through upper tip of sixth longitudinal scale row at midbody (occasionally present only on the fifth (in 17 specimens), sixth (in seven), sixth and seventh (in one) and fifth, sixth, and seventh (in three) longitudinal scale rows at midbody); lower secondary dark line begins on lower edge of last infralabial, lower one-third of seventh through upper tip of eighth longitudinal scale row of neck, lower half of sixth through upper third of seventh longitudinal scale row at midbody (Fig. 8a).

Squamation: Variation in squamation of 125 specimens of *E. copei* is given in Tables 1 and 2. Three specimens have only three supraoculars on each side and one has three on one side, four on the other. The lower number of supraoculars in some specimens of *E. copei* overlaps with the number of supraoculars present in *E. dugesii*. However, the dorsolateral light line is always present only on the median third of the third longitudinal scale row from the neck to the tail in *copei* and is never restricted to the third scale row in *dugesii*.

Taylor (1933) stated that the seventh supralabial always contacts the upper secondary temporal in *copei*, thereby separating the primary temporal from the lower secondary temporal. In the series of *copei* at hand, the primary temporal scale contacts the lower secondary temporal on one side in ten specimens, on both sides in eight specimens, consisting of approximately 10 per cent of the total sample examined (125 specimens).

The frontonasal does not contact the frontal in 22 specimens, 18 of which have the prefrontals in contact with each other; the remaining four have the frontonasal transversely divided, forming a small azygous scale between the frontonasal and the frontal.

Usually three supraoculars contact the frontal but occasionally only two contact the frontal on each side (in three specimens) or two on one side and three on the other (six specimens).

Localities: *DISTRITO FEDERAL*; Monte Alegre, Sierra Ajusco, AMNH, 1; Santa Rosa, UMMZ, 1; 1 mi SW Santa Lucia, AMNH, 1. *MEXICO*; Nevado de Toluca, AMNH, 34; Rio Frio, TCWC, 3, UIMNH, 13,

USNM, 1; 5 km W Rio Frio, UIMNH, 3, USNM, 9; 13 km W Toluca, UMMZ, 1; 10 mi N, 6 mi E Valle de Bravo, KU, 3; 24 km NW Toluca, MVZ, 7; Villa Victoria, UIMNH, 2; 8 mi W Villa Victoria, UIMNH, 1; Toluca, USNM, 2; 10 mi SE Asuncion, USNM, 1; 15 km W Toluca, USNM, 13; Tenancingo (Taylor, 1936); 3 mi W Zinacantepec (Taylor, 1943). *MICHOACAN*: Tancitaro, FMNH, 3; 9 mi W Zacapu, UIMNH, 1. *MORELOS*: Lagunas de Zempoala, TCWC, 9; UIMNH, 31, AMNH, 21, USNM, 19; 2 mi W Huitzilac, TCWC, 5; 3 km NW Tes Cumbres, TCWC, 2; 5 km N Tres Cumbres, TCWC, 17, KU, 2; 5 km S Tres Marias, UIMNH, 1; 6 km NW Huitzilac, KU, 2. *VERACRUZ*: Potrero Viejo, UIMNH, 1. *GENERAL*: Overland Route, USNM, 1.

***Eumeces ochoterenae* Taylor, 1933**

The maximum snout-vent length for this species is 52 mm ♂♂, 55 mm ♀♀; *ochoterenae* is the smallest species in the *brevirostris* group, averaging 48.3 mm ♂♂ and 49.4 mm ♀♀ in snout-vent length; color pattern consists of a dorsolateral light line beginning on rostral, passing posteriorly along outer half of supraoculars, nuchals, outer two-thirds of second longitudinal scale row for two to six transverse scales, descending to lower half of second through upper half of third longitudinal scale row to tail; upper secondary dark line usually from nuchals to tail along upper half of second longitudinal scale row, but often faint from midbody to tail; dorsal dark lines are absent, color between upper secondary dark lines brown, bronze, or dark brown; primary lateral dark line covers side of head from supralabials to supraoculars, on lower half of third through upper half of sixth longitudinal scale row of neck, on lower half of third through upper two-thirds of fifth longitudinal scale row at midbody; lateral light line faintly indicated on most specimens, consists of a series of light colored spots on scales of sixth and seventh or seventh and eighth longitudinal scale rows of neck and as a series of light centered, dark edged scales on the sixth longitudinal scale row at midbody (Fig. 8c); venter yellowish, tail blue.

Squamation: Variation in squamation of 39 specimens of *E. ochoterenae* is given in Tables 1 and 2. The interparietal is enclosed in two of 39 specimens. The seventh supralabial contacts the upper secondary temporal on both sides in 15 specimens, one side only in 13 specimens. Number of supraoculars contacting the frontal is usually three on each side but occasionally two contact the frontal on each side (two specimens) or two on one side and three on the other (three specimens). The primary temporal is absent on both sides in two specimens and on one side in two specimens. The longitudinal scale rows usually number 22 around the body, but 20 rows occur once and 24 rows occur eight times.

Localities: *GUERRERO*: Acahuizotla, TCWC, 1; Agua del Obispo, FMNH, 6, UIMNH, 2, TCWC, 1; near Agua del Obispo, FMNH, 3; 1 mi N Agua del Obispo, UMMZ, 1; near Chilpancingo, FMNH, 2; 12 mi S Chil-

pancingo, FMNH, 2, UMMZ, 1; 3 to 4 mi S Chilpancingo, FMNH, 10, UIMNH, 4; Chilpancingo, UIMNH, 1; 3 mi W Chilpancingo, TCWC, 1; 7 mi E Chilpancingo, 4 mi N Chilpancingo (Taylor, 1943); between Rincon and Cajones, UIMNH, 1, USNM, 1, AMNH, 1; Chilapa, USNM, 1; Mazatlan, UIMNH, 1.

***Eumeces colimensis* Taylor, 1935**

The maximum snout-vent length of *E. colimensis* is 65 mm ♀♀ (holotype), unknown in ♂♂; color pattern of holotype consists of a dorsolateral light line from rostral to posterior third of body, on outer half of supraoculars, inner tip of upper secondary temporal, median third of outer half of nuchals, most of second longitudinal scale row for two transverse scales, outer third of second and all of third longitudinal scale row for seven transverse scales, descending to lower half of third and most of fourth longitudinal scale row for 28 transverse scales, and in addition to the above, upper third of fifth longitudinal scale row for 19 transverse scales; upper secondary dark line extends from frontonasal to shoulder on upper half of second longitudinal scale row to middle of neck, descending to upper tip of third longitudinal scale row to midbody; anterior third of each dorsal scale row between dorsolateral light lines dark brown but not forming definite dorsal dark lines (Fig. 8d); lateral light line on seventh and eighth longitudinal scale rows of neck represented at midbody by a series of light spots on the posterior half of the seventh longitudinal scale row; primary lateral dark line from nostril, covering side of head from edge of supralabials to supraoculars, on lower half of third through upper half of sixth longitudinal scale row of neck, lower three-fourths of fifth through anterior half of seventh longitudinal scale row at midbody; venter whitish.

Two additional juvenile specimens from Michoacan are similar to the holotype in the position of the light and dark lines of the head and body, but the lateral light line is faint in one and obscure in the other and is not evident at midbody in either specimen.

Squamation: Variation in squamation of three specimens of *E. colimensis* is given in Tables 1 and 2. The two juvenile specimens from Michoacan differ from the holotype in having the number of scales in the superciliary series eight on each side in one, eight on one side and nine on the other in one (holotype with six on each side), 26 scale rows around body rather than 28; seventh supralabial not in contact with upper secondary temporal rather than in contact; primary temporal present on both sides rather than fused to the upper secondary temporal. However, the variation in the above characters falls within the range of variation for other species of the *brevirostris* group where larger samples are available.

The limbs are long in all three specimens, toes overlapping when adpressed along the sides of the body; toes relatively long with a corresponding increased number of lamellae beneath the fourth toe.

One additional specimen of *Eumeces* (KU 44733) from 1 mi E Santa Lucia, Sinaloa, cannot be placed with *E. colimensis* with certainty, although Webb (1959) recognized the individual as being *E. colimensis*. The major differences between the Sinaloan specimen and *E. colimensis* are: (1) presence of a well defined lateral light line from supralabials to tail (Fig. 8e) rather than obscure; (2) dorsolateral light line on lower half of second and upper two-thirds of third longitudinal scale row to tail, rather than descending to third, fourth and fifth, as in *colimensis*; (3) presence of a small primary temporal, with a large seventh supralabial contacting upper secondary temporal. The primary temporal is fused with the upper secondary temporal in the holotype, allowing a contact between the seventh supralabial and upper secondary temporal, but the seventh supralabial is small, only slightly larger than the sixth supralabial.

The Sinaloan specimen may be related to *E. callicephalus*, especially those populations lacking the postnasal, with bifurcating lines on the head in old adults and having a single postmental.

Localities: *COLIMA*; Colima, FMNH, 1. *MICHOACAN*; 0.5 mi NE Coalcoman, UMMZ, 1; 1 mi ESE Estopilas de Salitre, UMMZ, 1. *SINALOA*; 1 mi E Santa Lucia, KU, 1.

DISCUSSION

EVOLUTION OF *E. BREVIROSTRIS*

All populations of *Eumeces brevirostris* are found in pine-fir or pine-oak woodland communities between elevations of 1,800 and 11,000 feet in the mountain ranges of Mexico. Orogeny during Pliocene and Pleistocene times (volcanic upheaval and associated rise and fall of land mass along fault lines) and climatic shifts probably accounts for the disruption of the once continuous geographic range of the original parental stock of *E. brevirostris*. Since these times five recognized subspecies have become established.

The northern populations (*bilineatus* of northwestern Mexico, *dicei* and *pineus* of northeastern Mexico) are more similar to each other in having a reduced number of head scales and the loss or fusion of the primary temporal to the upper secondary temporal scale, than to southern and west central populations of *E. b. brevirostris* and *b. indubitus*. Two possible explanations for a similar reduction of head scales in two widely separated populations of northern *brevirostris* are: (1) the northern populations exhibited some head scale reduction prior to the climatic and physical changes produced during initial glaciation or before, these environmental changes restricted the two populations to their present habitats on each side of the Mexican Plateau; (2) parallel evolution in the reduction of head scales has taken place in these populations after they were separated during glacial minima.

Martin (1958) indicated that there may have been an oak-savanna corridor across the plateau during the Late Pleistocene that has been eliminated in the arid interior at the present time. He listed several plants and animals that

occur on either side of the plateau to support this idea. However, one also may assume that the entire plateau may have been oak-savannas during glacial maxima and the similar eastern and western plateau plants and animals are relicts of once wide-spread transplateau populations.

The absence of an enclosed interparietal, marked similarity of color pattern, and increase in number of head scales in *brevirostris* populations from Coahuila to eastern Oaxaca indicate that a connection probably existed between the present allopatric populations of *dicei* and *pineus* in Tamaulipas and *brevirostris* in Veracruz and Puebla, perhaps during glacial maxima. A thorough search of the small isolated mountain ranges between Puebla and Tamaulipas may reveal relict populations of this species along the eastern escarpment of the Mexican Plateau.

A possible route of gene exchange between populations of *brevirostris* from southern to northwestern Mexico may have been via the Transverse Volcanic Range across the southern edge of the plateau. Populations of *brevirostris* with a lateral light line and some individuals of the populations with an enclosed interparietal are found in central Puebla and western Veracruz. Populations with individuals showing a decrease in the length of the lateral light line and an increased presence of an enclosed interparietal are found in eastern Mexico-Morelos. Populations with an enclosed interparietal in most individuals and the lateral light line obscure occur in Jalisco and northwestward into Durango and Chihuahua.

The Transverse Volcanic Range seems to have been isolated from the Sierra Madre Oriental and occupied by a single population of *brevirostris indubitus* for some period of time. A more uniform environment may have allowed a re-invasion of the *E. brevisrostris indubitus* population from the Sierra Madre Oriental, following a glacial maximum. The suggested point of contact between the two formerly separated populations of *indubitus* and *brevirostris* probably occurred in the eastern part of the Transverse Volcanic Range (Puebla and Mexico). A shifting and infrequent intergradation of characters in this area suggests secondary contact and lends support to this hypothesis.

A large hiatus exists in the distribution of *Eumeces b. indubitus* from southern Jalisco to east central Mexico. The gap may be the result of insufficient collecting and probably does not represent an actual allopatric situation, since the habitat of this form is continuous across southern Jalisco, Michoacan, Mexico, and northern Puebla.

An additional hiatus exists between populations of *b. indubitus* and *b. bilineatus* from northwestern Jalisco to southern Durango. The valley of the Rio Santiago is an effective barrier to genetic exchange between northwestern Jalisco and southern Nayarit. Additional collecting in the small isolated mountain ranges of northeastern Jalisco and northwestern Guanajuato may reveal disjunct populations of *E. b. bilineatus* and indicate that a corridor may have formerly connected *E. brevisrostris* populations of the Transverse Volcanic

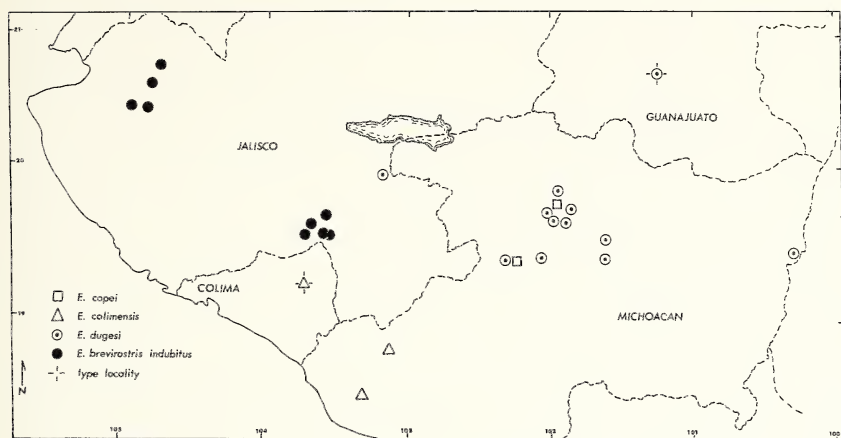


Figure 5. Map of the distribution of *Eumeces brevirostris indubitus*, *E. colimensis*, *E. copei*, and *E. dugesii* in west central Mexico.

Range and the Sierra Madre Occidental rather than through the mountains of northwestern Jalisco and southern Nayarit.

SPECIES RELATIONSHIPS

The significant scale and color pattern characters that separate the five species of the *brevirostris* group are combinations of interparietal enclosed or not enclosed; amount of contact between seventh supralabial and upper secondary temporal; number of supraoculars; number of longitudinal and transverse scale rows; lamellae beneath fourth toe; snout-vent length; length of limbs; presence and placement of a lateral light line; presence of a dorsolateral light line on one, two, or three longitudinal scale rows.

The color pattern of two to four longitudinal light lines (lateral two lines often incomplete) and squamation of the five species of the *brevirostris* group give a clue to the primitive member of the group. The color pattern of four complete, well-defined light lines in *E. copei* or an intermediate condition of two complete and two incomplete light lines in *E. dugesii* could be the primitive condition. *Eumeces copei* has a color pattern of four complete well-defined light lines; all other species show some loss of the lateral light lines. The dorsolateral light line is completely enclosed by the upper secondary and primary dark lines in *copei*, less so in the other four species. The lateral light line is enclosed by the primary dark line and the lower secondary dark line in *copei* and southern populations of *brevirostris*. It may or may not be enclosed in *dugesii* and is usually obscure in *colimensis*, *ochoterena*, and central and northern populations of *brevirostris*. The length of the dorsolateral light line is variable in all species except *copei* and *ochoterena*. Thus *copei*, showing a retention of

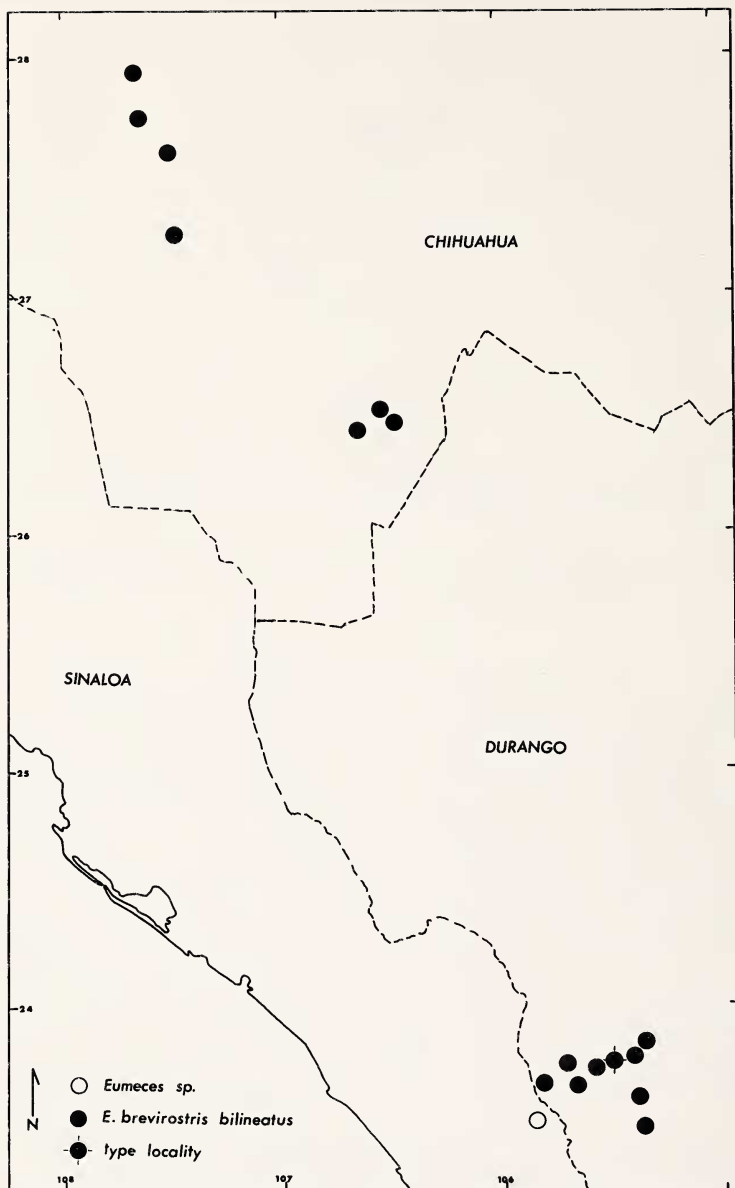


Figure 6. Map of the distribution of *Eumeces brevirostris bilineatus* and *E. sp.* in Chihuahua, Durango, and Sinaloa, Mexico.

all four lines, may have the primitive color pattern. However, *dugesii* is not only intermediate in color pattern, it is also intermediate in squamation when compared to the other four species.

The number of lamellae beneath the fourth toe is lowest in *ochoterenae*, followed in order by *dugesii*, *brevirostris*, *copei*, and *colimensis*. The number of transverse scale rows is lowest in *ochoterenae*, followed by *colimensis*, *dugesii*, *copei*, and *brevirostris*. The number of longitudinal scale rows varies from 20 to 26 in *brevirostris*, overlapping the range of variation found in the longitudinal scale rows of the other species. The number of superciliary scales, totaled for both sides, is usually 10 to 12 in northern populations of *brevirostris*, 13 to 14 in southern populations of *brevirostris* and all populations of *copei* and *ochoterenae*, 12 to 14 in *dugesii*, and 12 to 17 in *colimensis*. The number of post suboculars totaled for both sides is six to eight in all species of the group. The number of supraoculars is usually four on each side for all species except *dugesii*, which has three. The primary temporal is usually present in all species, except for northern populations of *brevirostris*. The least contact between the frontonasal and the frontal is found in *ochoterenae*, followed by *colimensis*, *brevirostris*, *dugesii*, and *copei*. Thus *E. dugesii* appears to be intermediate between other species of the group and may be the most primitive member, even though it has only three supraoculars. *Eumeces copei* and *E. ochoterenae* appear to be the most specialized members of the group in having scale characters usually not found in the other three species and in having the opposite extremes in color pattern.

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SUMARIO

Las especies nominales *Eumeces dicei* y *E. indubitus* muestran ser sub-spe-

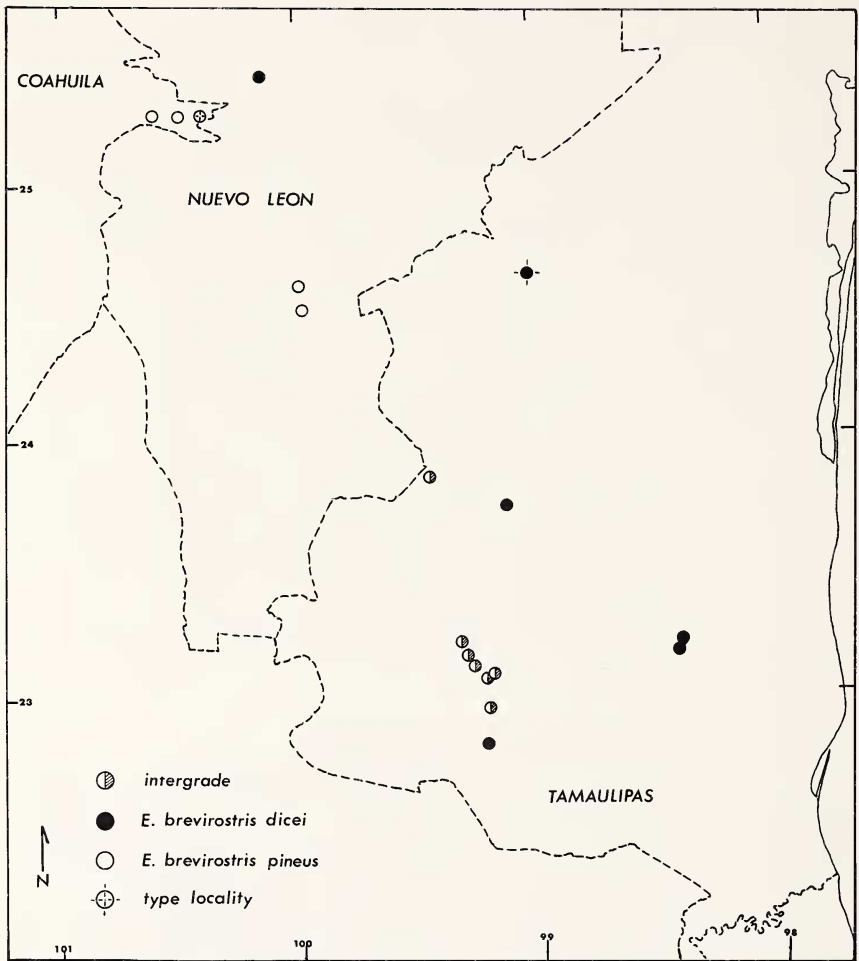


Figure 7. Map of the distribution of *Eumeces brevirostris dicei* and *E. b. pineus* in northeastern Mexico.

cies de *E. brevirostris*. *Eumeces copei* ha sido removida del grupo *E. anthracinus* y colocada en el grupo *E. brevirostris*. Un análisis crítico de las escamas y colorido ha sido hecho para este grupo. Claves, fotografías y mapas de distribución se presentan para cada forma. También se discute una posible explicación de la distribución de grupos de *E. brevirostris*.

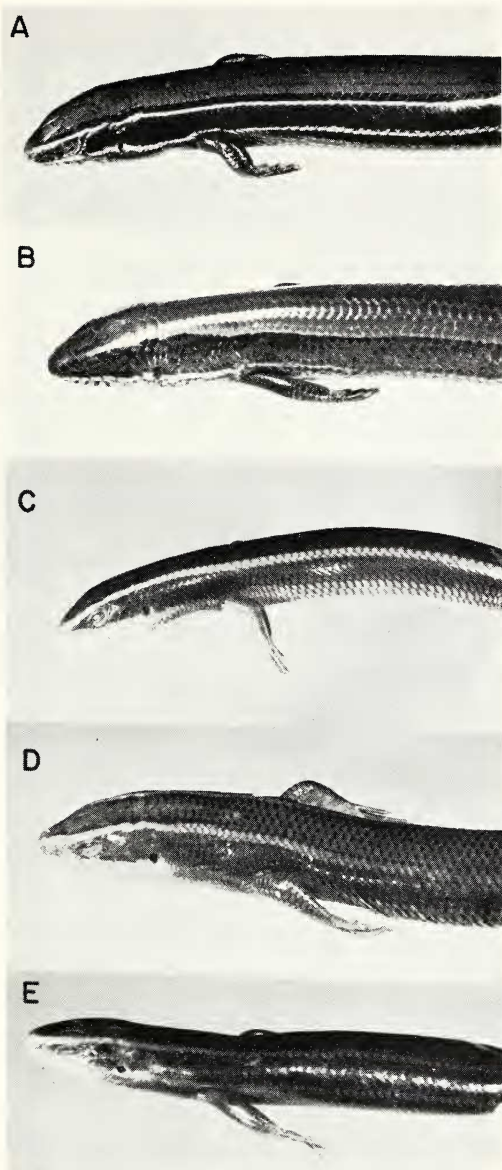


Figure 8. Dorsolateral view of the color patterns of four species of the *Eumeces brevirostris* group. A. *E. copei*, Zempoala, Morelos; B. *E. dugesii*, 12 mi S Carapán, Michoacan; C. *E. ochoteranae*, Agua del Obispo, Guerrero; D. *E. colimensis* (holotype), Colima, Colima; E. *Eumeces* sp. (*colimensis*), 1 mi E Santa Lucía, Sinaloa.

TABLE 2
Variation in three characters of squamation of the *E. brevirostris* group.

Number in sample	Number of dorsal transverse scale rows					Number of longitudinal scale rows					Number of fourth toe lamellae				
	RANGE	MEAN	SD	SE	RANGE	MEAN	SD	SE	RANGE	MEAN	SD	SE	RANGE	MEAN	SD
<i>Eumeces b. brevirostris</i>															
Oaxaca	102	50-63	57.5	2.40+ $\pm$ 0.24	20-24	21.9	1.00+ $\pm$ 0.10	10-15	11.4	0.95+ $\pm$ 0.09					
Guerrero	45	54-62	58.3	2.30+ $\pm$ 0.34	22-24	23.4	1.00+ $\pm$ 0.14	10-14	11.4	0.63+ $\pm$ 0.09					
Veracruz	31	57-65	60.2	2.10+ $\pm$ 0.37	22-24	23.4	0.90+ $\pm$ 0.16	11-14	11.9	0.78+ $\pm$ 0.14					
Puebla	32	56-65	60.3	2.10+ $\pm$ 0.36	22-24	23.2	1.00+ $\pm$ 0.17	10-15	12.1	1.00+ $\pm$ 0.18					
Mexico-Morelos	30	56-64	60.3	2.20+ $\pm$ 0.40	22-25	23.1	1.00+ $\pm$ 0.17	11-14	12.3	0.84+ $\pm$ 0.15					
<i>Eumeces b. indubitus</i>															
Morelos	27	55-65	59.6	3.00+ $\pm$ 0.57	22-24	23.6	0.80+ $\pm$ 0.16	11-14	12.2	0.84+ $\pm$ 0.16					
Mexico	15	55-62	59.5	2.00+ $\pm$ 0.51	24-24	24.0	—	—	11-15	12.3	1.20+ $\pm$ 0.32				
Jalisco	51	56-68	60.1	2.50+ $\pm$ 0.36	22-26	24.8	1.10+ $\pm$ 0.15	11-16	13.4	1.20+ $\pm$ 0.17					
<i>Eumeces b. bilineatus</i>															
Durango	40	54-65	58.7	2.10+ $\pm$ 0.99	22-26	23.7	0.80+ $\pm$ 0.36	10-13	11.3	0.78+ $\pm$ 0.12					
Chihuahua	8	56-59	58.0	1.00+ $\pm$ 0.36	22-24	23.8	0.60+ $\pm$ 0.20	11-11	11.0	—					
<i>Eumeces b. pineus</i>	42	55-65	59.8	2.20+ $\pm$ 0.32	20-24	22.1	0.80+ $\pm$ 0.17	11-15	12.9	1.10+ $\pm$ 0.17					
<i>Eumeces b. dicei</i>	11	57-65	61.0	1.90+ $\pm$ 0.60	22-24	23.6	0.90+ $\pm$ 0.27	11-14	12.8	0.90+ $\pm$ 0.27					
<i>Eumeces dugesii</i>	27	53-63	57.9	2.80+ $\pm$ 0.54	22-24	23.2	1.00+ $\pm$ 0.20	10-13	11.6	0.70+ $\pm$ 0.14					
<i>Eumeces copei</i>	125	55-65	59.6	2.00+ $\pm$ 0.18	20-24	22.2	0.80+ $\pm$ 0.07	11-14	12.5	0.78+ $\pm$ 0.07					
<i>Eumeces ochoterenae</i>	39	49-57	53.7	1.60+ $\pm$ 0.26	20-24	22.4	1.00+ $\pm$ 0.16	10-12	11.1	0.78+ $\pm$ 0.12					
<i>Eumeces colimensis</i>	3	54-55	54.7	—	26-28	26.9	—	—	15-17	16.0	—				

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